

Research Article

Oral Stereognosis in Patients with Completely Edentulous Jaws

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Abstract

Thirty patients with completely edentulous jaws (the main group) and 30 patients without denture defects and treated oral cavity (the control group) were examined in order to study oral stereognosis. Standard H. Landt sets were used. The rate of tactile assessment of the objects shape in the oral cavity of the patients with completely edentulous jaws was established to decrease by 2.6 times on average in comparison with the control group, and the percentage of correctness of the sample determination decreased by 44.4%. After one month of prosthodontic treatment of the patients with completely edentulous jaws with the use of complete laminar dentures, the rate of tactile assessment of the objects' shape increased by 18.3% and the index of the correctness of the sample determination increased by 31.5%. The results of the oral stereognosis study showed that the duration of collecting and analysis of receptor signals of oral mucosa in the patients with completely edentulous jaws was longer than in the patients without denture defects. However, the tactile sensitivity of the oral mucosa had the ability to recover in one month after prosthodontic treatment with complete laminar dentures.

Keywords

oral stereognosis; completely edentulous jaws; complete laminar dentures

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Problem statement and analysis of the recent research

Completely edentulous jaw is one of the most common dental diseases [8]. The percentage of the patients who have lost their teeth completely constitutes 26% at the age of 65 years and reaches 44% at the age of 75 years [2, 12]. Completely edentulous jaws occur due to the same causes as partially absent dentition. They include complication of dental caries, periodontal disease, specific inflammatory processes [3, 8, 9]. All elements of dentofacial system are closely interconnected and changes in any of them lead to a restructuring of the whole system [5]. Completely edentulous jaws result in topographical changes in the ratio of organs and oral cavity tissues. Therefore, the examination of the oral cavity with completely absent dentition has a specific nature since the oral cavity with completely edentulous jaws is significantly different from the oral cavity with preserved teeth. Special attention should be given to the study of the features of the oral cavity clinical presentation in case of completely edentulous jaws. The bone basis, namely alveolar processes and parts, jawbones, bony palate and oral mucosa should be carefully examined [9]. Mucous membrane is known not to be adapted phylogenetically to direct perception of masticating pressure, therefore knowledge of its structure and functional state in case of completely edentulous jaws is important [3].

Over the last years, oral stereognosis has been used more often as an informative and underexplored method of the study

of oral mucosa tactile sensitivity [4, 7, 10, 15]. Professor R. Marxkors pays special attention to oral stereognosis for planning of prosthodontic treatment of patients with completely edentulous jaws [6]. The term "oral stereognosis" denotes the ability of a person to adequately assess the shape and geometrical dimensions of solid objects using tactile receptors of oral mucosa [11].

The objective of the research was to study oral stereognosis in the patients with completely edentulous jaws.

1. Materials and methods

Oral stereognosis in 30 patients with completely edentulous jaws (the main group) was studied in order to achieve the objective of the research. The control group consisted of 30 patients without denture defects and treated oral cavity. The study of oral stereognosis in the main group was conducted before the prosthodontic treatment, and in 1 and 3 months after its completion. The prosthodontic treatment included the manufacture and use of complete laminar dentures according to the generally accepted technique [2]. The age of patients, both in the primary and in the control groups, ranged from 45 to 89 years.

Two types of H. Landt sets (Fig. 1) for oral stereognosis were made of "Synma M" plastic in the dental laboratory of the Department of Stomatology of Postgraduate Study Faculty of the Ivano-Frankivsk National Medical University in order to conduct oral stereognosis. The first type was the original,

the second type was geometric figures eightfold increased [6, 11].

The method of oral stereognosis was conducted in the following way: the patient was asked to close his or her eyes and randomly chosen figure from the original H. Landt set was put on his or her tongue with tweezers. The set eightfold increased for illustration was demonstrated and the stopwatch was turned on. Then the patient was asked to indicate which of the samples was in his or her oral cavity. When the patient chose the shape of the sample, the stopwatch was stopped. The patient was asked to spit the figure on the tray and he or she had not to see the model and not to touch it with his or her hands (Fig. 2). Thus, all figures were placed in the patient's mouth in turn and the patient was asked to determine their shape.

The criteria for the assessment of oral stereognosis were the time required for the patient to recognize the shape of the figure and the percentage of correct sample determination.

All the data were statistically processed using embedded license analysis packages and descriptive statistics in Microsoft Excel 2007 and Statistica 6.0. The clinical data obtained in the study were first verified for the type of their distribution according to the Kolmogorov-Smirnov test and method proposed by Liljefors. Since the absolute majority of these data corresponded to the normal Gauss's law, the standard error ($M \pm m$) was chosen to describe the central tendency. To evaluate the reliability of the differences in the results obtained, and to test the null hypothesis, a parametric t-test (the Student's test) for dependent or independent samples was used [1].

2. Results and discussion

The results of oral stereognosis study in the patients of the main group before the prosthodontic treatment and in the control group are presented in Table 1.

The results of oral stereognosis study showed that a decrease in the tactile sensitivity of oral mucosa occurred in case of completely edentulous jaws. Therefore, the person was not able to assess adequately the shape of the geometric figure. Thus, the analysis of the time during which the patient correctly determines the shape of the sample showed that the rate of tactile assessment of the objects shape significantly decreased by 2.4 times ($p < 0.05$) in case of completely edentulous jaws (the main group). We also analyzed the percentage of correctness of sample determination in the main and control groups. This index was by 44.4% lower in case of completely edentulous jaws in comparison with the control group.

The dynamics of oral stereognosis indices under the influence of prosthodontic treatment is presented in Table 2.

According to the analysis of the data obtained 1 month after the prosthodontic treatment, a significant reduction in the time required to determine the shape of geometric shapes was observed in all patients of the main group. The time of one sample determination decreased by 18.3% ($p < 0.05$) in one month after prosthodontic treatment as compared to the results before the treatment. It was also noted that the patients

were mistaken less often when determining the shape of the geometric figure. The index of correctness of sample determination significantly increased by 31.5% one month after prosthodontic treatment in comparison with the index before the treatment. The results of oral stereognosis indicated that the presence of complete laminar dentures probably restored the tactile sensitivity of the oral mucosa. Amarasena J et al. [14], Dahiya D. [10] observed in their studies the improvement of oral sensations as a result of the use of complete laminar dentures for 1 month; Singh V. [15] has also made a conclusion that "covering of the palatal mucous membrane with a denture does not reduce oral stereognostic senses".

Oral stereognosis was repeatedly conducted in the main group of the patients in 3 months and the indices were compared with the results obtained 1 month after the prosthodontic treatment. However, the indices of oral stereognosis slightly improved in 3 months, but they were not so prominent in order to reach the probability results. In particular, the time of one sample determination decreased only by 5.6% as compared to the results that were 1 month after the prosthodontic treatment, and the index of correctness of samples determination similarly increased only by 6.1%.

Markskors R. [6] and Kovaleva I.A. [4] paid attention to the fact that the highest restoration of oral cavity sensitivity after using complete removable laminar dentures is achieved 5 weeks after their fixation. Markskors R. [6] also pointed out that indicators of oral stereognosis should be used in the planning of prosthodontic treatment with complete removable laminar dentures and at the same time he indicated that the results of the study of oral stereognosis require more detailed study and discussion.

3. Conclusions

Thus, the results of oral stereognosis study indicated that the duration of collecting and analysis of receptor signals of oral mucosa in the patients with completely edentulous jaws was longer than in the patients without denture defects. However, the indices of oral stereognosis significantly improved after 1 month of prosthodontic treatment with complete laminar dentures in the patients with completely edentulous jaws. This indicated the ability of tactile sensitivity of the oral mucosa to recover.

4. Prospects for further research

The study of oral stereognosis in patients with completely edentulous jaws provides new possibilities to solve the problems of patients' adaptation to complete laminar dentures. In particular, along with the study of oral stereognosis results (this study is referred to as TF-test (Recognition of Forms) in American and British literature), the study of a patient's ability to fine coordination of masticatory muscles (the MA-test (Muscular-Ability)) is also promising [13]. The use of MA-test is also important as a stimulator of oral stereognosis

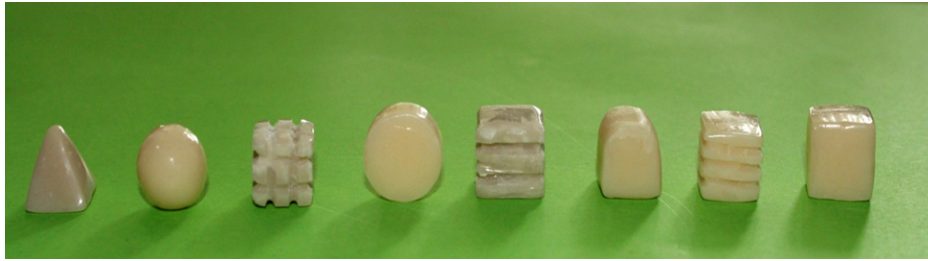


Figure 1. Geometric figures used for oral stereognosis.

Table 1. Oral stereognosis in the main group (before the prosthodontic treatment) and in the control group

Group	Index	
	Average time (seconds) for one sample determination	Correctness of sample determination (%)
Main (n=30)	36.58 ± 1.44 $p < 0.05$	51.67 ± 4.78
Control (n=30)	15.56 ± 1.08 $p < 0.05$	92.92 ± 1.52

Notes: p – the probability of the index difference in comparison with the control group.

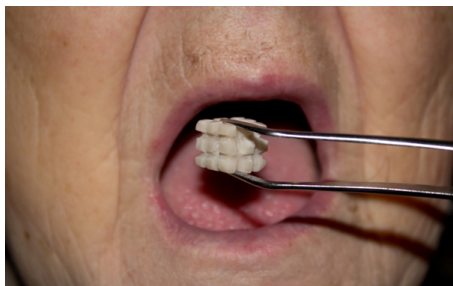


Figure 2. Oral stereognosis for a 70-year-old patient L.

in order to improve adaptive processes to complete laminar dentures in patients with completely edentulous jaws.

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Table 2. The dynamics of oral stereognosis indices

Index	Time period			
	The main group			The control group (n=30)
	Before the prosthodontic treatment	1 month after the prosthodontic treatment	3 months after the prosthodontic treatment	
Average time (seconds) for one sample determination	36.58±1.44 p<0.05	29.88±1.44 p ₁ <0.05	28.37±1.40 p ₂ >0.05	15.56±1.08
Correctness of sample determination (%)	51.67±4.48 p<0.05	67.92±4.03 p ₁ <0.05	72.08±3.94 p ₂ >0.05	92.92±1.52

Notes:

p – the probability of index difference in comparison with the control group;

p₁ – the probability of index difference as compared to the time period before the denture treatment;

p₂ – the probability of index difference in comparison with the time period 1 month after the denture treatment.

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